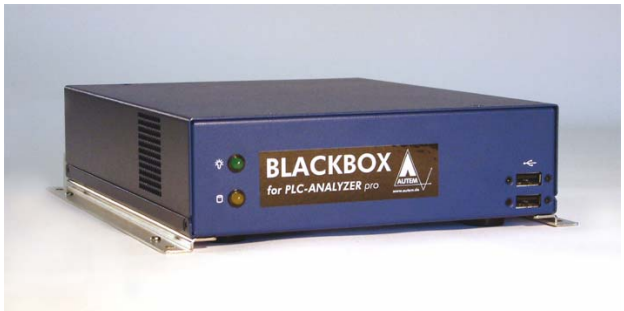
BLACKBOX

for

PLC-ANALYZER pro *5*



Long-term PLC process data recording and remote maintenance
with *PLC-ANALYZER* pro *5*
Mini-PC for integration in a switching cabinet

AUTEM

BLACKBOX for *PLC-ANALYZER pro 5* User Manual

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1st. Edition 2005

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1 Introduction

1.1 Overview

The BLACKBOX from AUTEM provides an ultra-compact data acquisition computer for the long-term recording of PLC signals and external electrical values (PLC process data archiving) and also remote maintenance using the PLC-ANALYZER pro 5. Due to its small dimensions, the system can be integrated in a switching cabinet without any problem.

The BLACKBOX can continuously record and archive PLC signals over a longer period of time; typically in excess of 3 years.

> **!** **WARNING**
>
> Errors that can occur in the automated facility endangering humans or causing large-scale material damage must be prevented by additional external measures. These measures (e.g. independent limit monitors, mechanical interlocks) must guarantee safe operation even in the case of dangerous errors.

> **!** **WARNING**
>
> If you use the BLACKBOX within an unprotected network you should install Windows security updates regularly.

> **!** **Revocation of guarantee**
>
> The warranty BLACKBOX is 12 months. The warranty no longer applies if the product is tampered with, or if the product is not handled properly, or if the product is stored under adverse conditions. The warranty also no longer applies if the device is used in a fashion that does not correspond to the manufacturer's intended use, or if used after wear-and-tear has taken effect, or if used with incorrect current or voltage, or if used after damage by surge, lightning, fire, water (dampness). The warranty no longer applies if the guaranty seal is removed or rendered unreadable.

The BLACKBOX is connected to the PLC by means supported by the PLC-ANALYZER pro 5, i.e. via connection to the PU interface or an automation network (MPI, PROFIBUS, Industrial Ethernet TCP/IP, Modbus+ …).

The recording of any electrical signal outside the PLC is also possible by means of the AD_USB-Box (optional).

The BLACKBOX automatically begins recording signals after being switched on and then operates autarkical.

1.2 Field of application

Long-term PLC process data recording

Failure diagnosis

Determine cause of production loss

Preventive maintenance

Documentation (QA), TPM, QEE

PLC Remote-Service

1.3 Performance characteristics

Massive steel case

Housing dimensions (WxDxH): 17.7 x 22.8 x 5.1 cm

Connections: PS/2 keyboard, mouse, VGA, 2 x USB, 1 x RS232, 3 x RJ45 LAN 10/100 Base-TX

Watchdog monitoring

Life Indicator LED

Free, floating contact for external operating status signals

Power supply 16 - 24 Volt DC, 2.5 A

Incl. external power adapter 100 - 240 Volt AC, 50 - 60 Hz

Siemens CP 5611 - SIMATIC-NET PROFIBUS / MPI connection (PCI-card) or other PLC Adapter (optional)

Remote maintenance software and TP RJ45 cross-over network cable to remote PLC and signal file access via external PC (Win9x/NT/2000/XP)

Remote control via modem or Internet (VPN) possible (remote maintenance)

Windows XP Pro operating system

The BLACKBOX signal recording capacity is normally sufficient for over 3 years

Software is completely installed, preconfigured and ready for operation

Can only be supplied in conjunction with first license PLC-ANALYZER pro 5 for BLACKBOX

Operating temperature range: 0 - 40 °C

48 -hour burn-in, CE certificate

Warranty: 12 months

1.4 Typical operation

Create a project with PLC-ANALYZER pro 5 and save it in the BLACKBOX directory

Switch off BLACKBOX

Connect BLACKBOX with the PLC

Switch on BLACKBOX

Check Life Indicator LED

Process data recording is running ✓

1.5 Help / Support

Should problems occur when using the BLACKBOX for the PLC-ANALYZER pro 5, please read this user manual thoroughly for assistance. There is an FAQ list at our Web site **http://www.autem.de** containing answers to frequently asked questions.

Please contact our technical support if you cannot solve the problem:

Technical Support AUTEM:

Tel. +49-(0)4921-9610-0
Fax +49-(0)4921-9610-96
eMail support@autem.de

Please have the following information at hand in addition to an **exact error description**:

Version and serial number of PLC-ANALYZER pro

Serial number of the BLACKBOX

PLC model and CPU type (e.g. SIMATIC S7-300 / CPU 314) and release number

2 Installation

2.1 Installation

Due to the small dimensions, the BLACKBOX can be installed directly in a switching cabinet. Please refer to *Fig. 2-1* for the exact dimensions.

During installation, pay attention that the air vents on the left/right/rear sides of the housing remain free to ensure sufficient ventilation. It can be installed either horizontally or vertically.

The BLACKBOX should be protected against vibration and impacts. If necessary, use rubber shock absorption pads during installation to protect the BLACKBOX from ambient vibration.

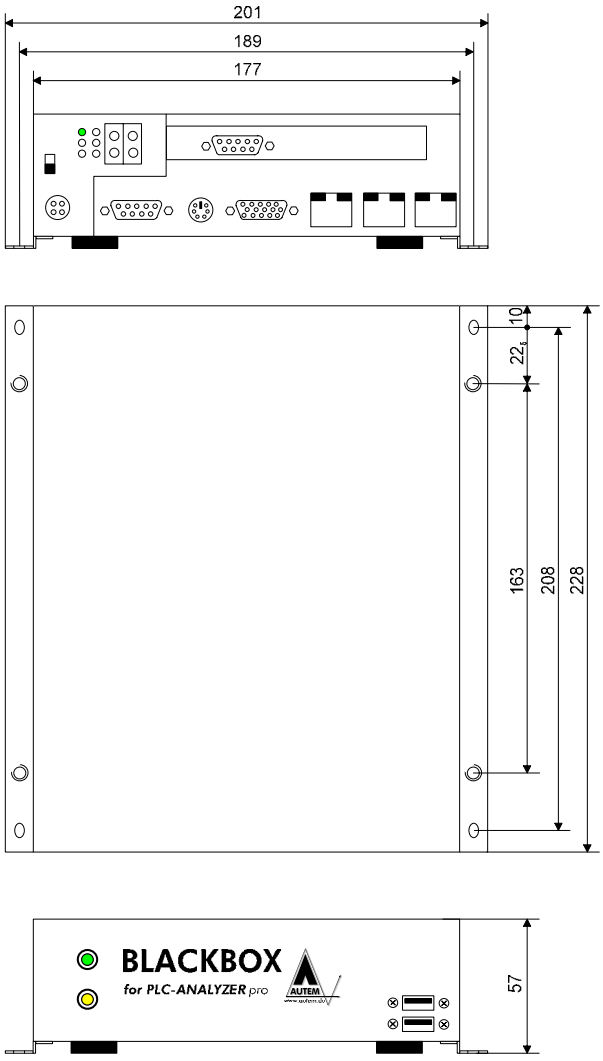

Fig. 2-1 BLACKBOX dimensions

Connect the BLACKBOX to power supply. The BLACKBOX requires a power supply of 16 - 24 Volt DC, 2.5 A. An appropriate DC connector is part of the material supplied. ***Fehler!***

Verweisquelle konnte nicht gefunden werden. provides instructions for mounting the DC connector.

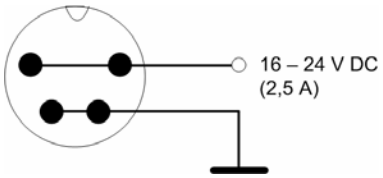

Fig. 2-2 Pinout Power Supply

Alternatively, the power adapter supplied can be used in order to operate the BLACKBOX with 100 - 240 Volt AC, 50 - 60 Hz.

Connect the data cable between the BLACKBOX and the PLC.

2.2 Floating contact for external operating status signals

A floating contact located on a luster terminal on the rear of the BLACKBOX provides the option of externally monitoring the operating status of the BLACKBOX. When signal recording is operating properly, the contact is closed. In the case of an interruption of the recording, or the computer malfunctions or crashes, the contact opens. Electrical load: max. 15 W / 200 VDC.

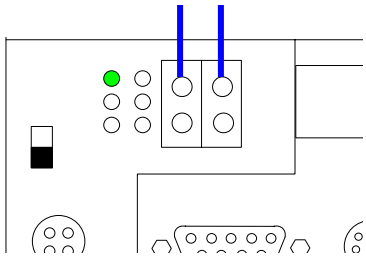

Fig. 2-3 Floating contact connection (luster terminal on rear side of housing)

2.3 Installation of additional hardware

Other hardware components may need to be connected, depending on the purpose for which the BLACKBOX is being used. Examples of this are a modem for remote maintenance via remote data transmission or an external CD writer.

2.4 Installing the software

The BLACKBOX is supplied with the requested software configuration ready installed. Other software components may need to be installed, depending on the purpose for which it is being used.

3 Starting up and operation

There are two methods with which to start up the BLACKBOX for the first time for configuration purposes. These are explained in the following sections.

NOTE

The BLACKBOX is equipped with a Watchdog which monitors the signal recording. In the case of an unforeseen interruption of the recording or a computer crash, the Watchdog causes a RESET to be triggered so that the BLACKBOX is automatically rebooted.

The precise way in which the Watchdog functions and possibilities to deactivate it are described in detail in *Section 3.4.*

3.1 Operation using keyboard, mouse and screen

Connect the keyboard, mouse and screen to the corresponding connections on the BLACKBOX.

Switch on the BLACKBOX.

Press and hold the <Ctrl> key during the entire boot routine so that the PLC-ANALYZER pro 5 is not automatically started and activation of the Watchdog is prevented (also refer to *Section 3.4*).

The BLACKBOX can then be operated as a normal PC running under Windows.

3.2 Remote operation using a cross-over direct connection (LAN)

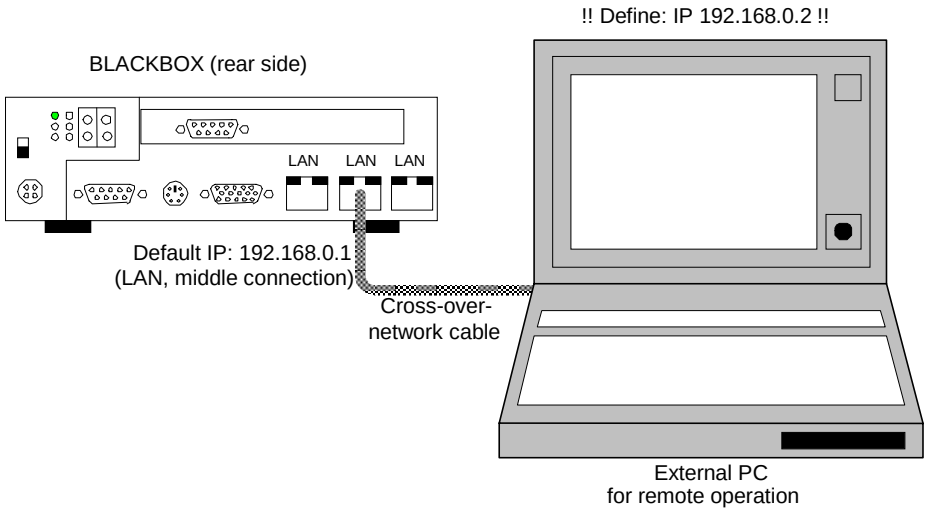

Fig. 3-1 LAN cross-over direct connection for remote operation

For remote operation of the BLACKBOX, a PC or Notebook running under Win9x / NT / 2000 / XP is required.

Connect the middle LAN connection on the BLACKBOX to the external PC using the cross-over network cable supplied.

Set the IP address for the network connection of the PC to 192.168.0.2.

Since the hard disk C: of the BLACKBOX is enabled in the network, access is already available to the drive (Explorer / Network Neighborhood), e.g. to copy PLC-ANALYZER pro 5 signal or project files.

If Windows XP (Home or Professional) is not installed on the PC, the client for the remote operation must be installed on the external PC first of all. Otherwise, skip the following instruction: The client is located on drive C: of the BLACKBOX under `c:\blackbox\client\msrdpcli.exe`. Start the file and follow the instructions in order to install the client.

Start the remote client. It is located under:
Start / Alle Programme / Zubehör / Kommunikation / **Remotedesktopverbindung**
or.
Start / All Programs / Accessories / Communications / **Remote Desktop Connection**

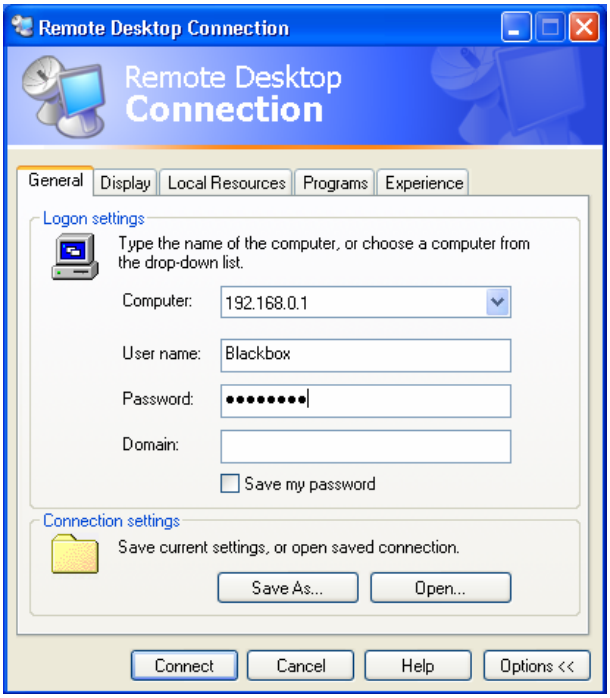

Fig. 3-2 Structure of the Remote Desktop Connection

Enter the *logon settings*:

Computer: 192.168.0.1 (IP address of the BLACKBOX)
Benutzername/User name: Blackbox
Kennwort/Password: Blackbox

Select the *Lokale Ressourcen/Local Resources* tab and click on the *Laufwerke/Disk drives* checkbox. This is useful because it enables access to the local drives of the external PC during remote operation of the BLACKBOX.

Fig. 3-3 Enable access to the local drives of the external PC

Then press the *Connect* button. The remote desktop connection is established. The BLACKBOX can then be controlled by remote operation.

NOTE

If necessary, the individual LAN connections of the BLACKBOX can also be assigned any other IP addresses. Note down any change made to the IP address of the middle LAN connection clearly because it is essential for establishing a connection for remote operation. More detailed information on network parameter settings in Windows is available in the Windows Help.

NOTE

If necessary, the user name and password of the BLACKBOX (Default: "Blackbox") can be modified under *Start / Control Panel / User Accounts*. Note down any changes to the settings clearly. More information is available in the Windows Help.

3.3 Further options for remote operation

3.3.1 Remote operation via Intranet (LAN)

Remote operation via Intranet is, in principle, identical to remote operation using a cross-over cable (refer to *Section 3.2*). In this case, the BLACKBOX is connected to an Ethernet hub by means of a patch cable in order to be available in the network.

NOTE

Use a standard patch cable to connect the BLACKBOX to a hub.

The cross-over cable supplied is a crossed cable which can only be used for the direct connection of two computers.

Ensure that the corresponding LAN connection of the BLACKBOX is assigned to an IP address appropriate to the network address scheme.

3.3.2 Remote operation via Internet (VPN)

Remote operation of the BLACKBOX can also be performed via Internet. Normally, a VPN (Virtual Private Network) is set up for this purpose. Modern Windows versions (e.g. Windows XP) are already prepared for this. Define the necessary settings under *Start / Control Panel / Network Connections* (XP).

More detailed information on network parameter settings in Windows is available in the Windows Help.

3.3.3 Remote operation using remote data transmission (via modem)

Remote operation of the BLACKBOX can also be performed via a modem (DFÜ/ Rempte data transmission). To do this, a modem or an ISDN adapter must be connected to the BLACKBOX. Define the necessary settings under *Start / Control Panel / Network Connections* (XP).

More detailed information on network parameter settings in Windows is available in the Windows Help.

3.3.3.1 Settings BLACKBOX

Click „Create a new connection“.

Select assistant „Set up an advanced connection“. Next.

Select „Accept incoming connections“. Next.

Select modem. Next.[1]

Select „Do not allow virtual private connections“. Next.

[1] If you use an ISDN adapter choose „PPP over ISDN“ („PPP“, „PPPoE“) as DFÜ device

Select via „Users allowed to connect“: BLACKBOX . Next.

Open the properties of the TCP/IP-connection. Set via „Specify TCP/IP address“ the TCP/IP-address from 192.168.0.1 to 192.168.0.10. Activate the control field „Allow calling computer to specify its own IP address“. OK. Next. Finish.

3.3.3.2 Settings PC, which will be connected with the BLACKBOX for remote control

Click via Control Panel / Network Connections on „Create a new connection“.

Select via assistant „Connect to the network at my workplace“. Next

Select „Dial-up connection“. Next.[1]

Enter name fort he connection (e.g. „BLACKBOX - BMW, USA“). Next.

Enter via „Phone number“ the phone number of the BLACKBOX-modem. Next.

Activate „Add a shortcut to this connection to my desktop”. Finish.

By double click on the new symbol of your desktop a window will open to enter user name „Blackbox“ and pass word „Blackbox“. Under „Connect“ the phone number of the modem should be registered already.

Now press „Connect“. The connection to the BLACKBOX starts.

After connection, open „Remote Desktop Connection“ (via „Start – All programs – Accessories - Communications“).

3.4 Watchdog

The BLACKBOX is equipped with a Watchdog which monitors the signal recording. In the case of an unforeseen interruption of the recording or a computer crash, the Watchdog causes a RESET to be triggered so that the BLACKBOX is automatically rebooted.

Watchdog is always activated when the PLC-ANALYZER pro 5 is started with the `-watchdog` parameter active (setting in Startup).

There are three ways in which to **deactivate** the BLACKBOX Watchdog function for maintenance work and remote operation:

Hold the <Ctrl> key pressed during the boot routine (only with a keyboard which is connected directly).

Manual termination of signal recording in PLC-ANALYZER pro 5.

Availability of a PC for remote operation of the BLACKBOX in the network whose IP address (network address) was made known to the PLC-ANALYZER pro 5 during startup with the `-cip:<ip-address>` parameter (refer to *Section 4.3*)

[1] If you use an ISDN adapter choose „PPP over ISDN“ („PPP“, „PPPoE“) as DFÜ device

4 Operation with *PLC-ANALYZER pro 5*

Before beginning long-term data acquisition, the PLC-ANALYZER pro 5 must be appropriately configured. The most important steps are described, briefly, below.

More information on the PLC-ANALYZER pro 5 is available in *PLC-ANALYZER pro 5 User Manual*.

NOTE

The BLACKBOX requires a special version of the PLC-ANALYZER pro 5. This is supplied together with the BLACKBOX and is already installed.

4.1 Creating the project for signal recording

Start the PLC-ANALYZER pro 5 and create a project file for recording the signals. The PLC-ANALYZER pro 5 is configured in such a way that the signal recording defined in the project begins automatically after starting the BLACKBOX. Information on the PLC-ANALYZER pro 5 start parameters is provided in *Section 4.3*.

For reasons of data integrity, it is recommended to limit the size of the signal files created for long-term recording. We recommend a size of 60 minutes. Select *Project / Project Options / Acquisition Mode* and set *Signalfile Size* to 60 minutes.

If not specified otherwise, signal files are stored to the hard disk up to 300 MB free space. Thereafter the oldest signal files are being automatically deleted step by step (FIFO ring buffer). With `-d` you can specify a period of time in days, after that the oldest signal file is being deleted gradually (refer to *Section 4.3*).

Save the project on the BLACKBOX hard disk in the `c:\blackbox\project` folder under the name `blackbox.prj`.

4.2 Start signal recording

Open `c:\blackbox\project` and check whether a valid project file `blackbox.prj` is available.

Terminate the Windows session and switch the BLACKBOX off.

Check that the connections to the PLC and power supply are correct. If the BLACKBOX should operate autarkic, disconnect the connections to the keyboard, mouse and screen.

Switch on the BLACKBOX. The system is booted and signal recording should start, fully automatically, after about 1 minute.

The green Life Indicator LED (rear side of BLACKBOX housing, *see Fig. 4-1*) flashes at intervals of one second when signal recording has been started successfully.

The system is now active. Signal files are subsequently recorded according to the project settings.

The BLACKBOX enables a practically continuous recording of signals over several years. When the capacity has been reached, the oldest signal file is automatically deleted to create space for new signal data.

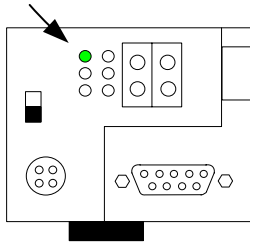

Fig. 4-1 Life Indicator LED on the rear side of the housing

NOTE

If the green Life Indicator LED does not start to flash at intervals of one second after 2 minutes, signal recording has not been started successfully. Also, permanent rebooting of the BLACKBOX ("Beep") indicates that signal recording has not been successfully started.

4.3 Start parameters for *PLC-ANALYZER pro 5*

The PLC-ANALYZER pro 5 is started automatically through an entry in the Windows *Startup* folder after the BLACKBOX has been booted.

The syntax of the PLC-ANALYZER pro 5 start parameters is explained below:

```
anawin [–run] [-watchdog] [-cip:<Client-IP>] [<projectfile>]
```

Example (BLACKBOX default setting):

```
anawin -run -watchdog -cip:192.168.0.2 blackbox.prj
```

Parameter	Description
-run	Signal recording in the project <projectfile> is started automatically after starting the PLC-ANALYZER pro 5.
-watchdog	Activates the Watchdog feature when the PLC-ANALYZER pro 5 is started (also refer to *Section 3.4*).
-d:<days>	Specifies the size of the „ring buffer“. Signal files, which are older than the number of days specified, are being deleted. For this, PLC-ANALYZER pro 5 only cares for those signal files, which were created during the current session (also refer to *Section 4.1*)

Parameter	Description
-cip:<client-IP>	Specifies the IP address of the PC for remote operation. If a PC assigned this IP address is available in the network on starting the PLC-ANALYZER pro, Watchdog is not activated (also refer to *Section 3.4*).
<projectfile>	Project file with predefined settings for recording signals.

Table 4-1 PLC-ANALYZER pro 4 start parameters for BLACKBOX

The start parameters can be changed by opening *Start / All Programs / Startup*. Position the mouse on *PLC-ANALYZER pro 5* and click the right mouse. The start parameters can then be modified in the *Properties / Shortcut / Target* menu.

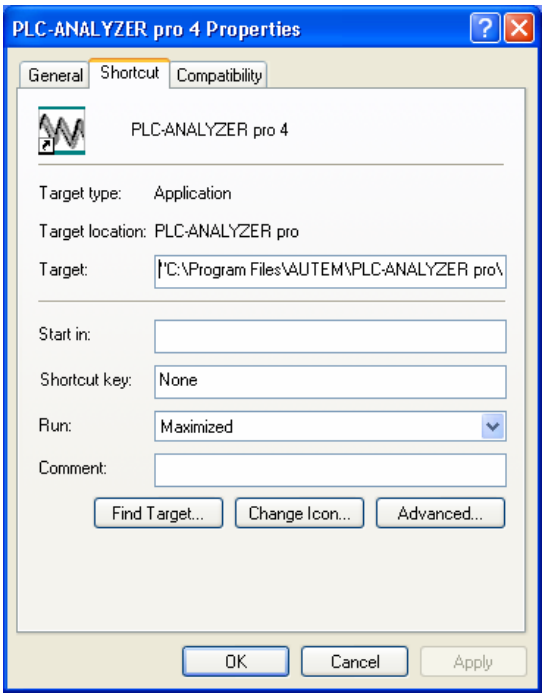

Fig. 4-2 Changing the PLC-ANALYZER pro 4 start parameters

4.4 Reading out recorded signal files

Signal files can be copied at any time from the `c:\blackbox\signal` folder - even when signal recording is actually running. For more information on operation, refer to *Section 3*.

5 Appendix A - Mounting BLACKBOX DC-Connector

NOTE

Solder the cables to the appropriate contacts at the connector before mounting the connector!

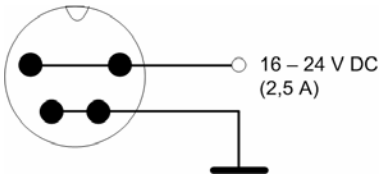

Abb. 5-1 Pin assignment DC-Connector

1		
2		
3		
4		
5		
6		
7		

Tabelle 5-1 Mounting BLACKBOX DC-Connector